IN THE SPECIFICATION

Please replace the paragraph on page 2, line 13 with the following amended paragraph:

-- The low efficiency in waveguide-to-semiconductor coupling devices is a serious problem in photonics chips. A majority of waveguides are comprised of low index materials (SiNx: 2.2, SiOxNy: 1.5), while other standard semiconductor devices, such as detectors, modulators, emitter, and amplifier are comprised of high index structures (Ge: 4.2, Si:3.5, GaAs: 3.6). One example of inefficient coupling is between a Ge detector and waveguide. Approximately 40% of incident light is reflected between Ge and SiNx causing significant Fresnel loss. In most photonic applications, this amount of loss is unacceptable and very inefficient. In evanescent coupling the propagation velocity mismatch between the waveguide and Ge detector needs a long coupling length. A long coupling length would be ~~an~~ inefficient ~~to be used~~ in photonic applications because size is an essential factor that needs to be controlled for such applications to operate efficiently with minimum loss. --

Please replace the paragraph on page 4, line 11 with the following amended paragraph:

-- The invention attempts to address the inefficiency presented by waveguide-semiconductor coupling devices by improving its efficiency. By forming an appropriate waveguide/semiconductor interface, one can control the Brewster angles for TM modes which will minimize the reflection of these modes. Moreover, the incorporation of a multimode interferometer (MMI) in the waveguide can be used to minimize the reflection of TE modes in a waveguide-semiconductor coupling device. The combination of the ~~improve~~ improved waveguide/semiconductor interface and the incorporation of a MMI structure in the waveguide improves significantly over other standard waveguide-semiconductor coupling devices. --

Please replace the paragraph on page 5, line 13 with the following amended paragraph:

-- The Ge mesa 4 is formed using standard techniques in the art. Note that the Ge mesa 4 is formed with a tapered edge 12. This tapered edge 12 provides the means to control TM mode reflections. In addition, the Ge mesa 4 provides an interface between the SiNx

waveguide 6 and the Ge detector 8 that efficiently limits the reflections of TM modes. The waveguide 6 is also tapered 14 at its end to form the Brewster angle necessary to limit reflections. The Ge mesa 4 is naturally formed in the selective growth of Ge epilayers on a Si layer 20 at least in UHV-CVD. Afterwards, the waveguide 6 materials are deposited and SiO_2 is deposited to form upper cladding ~~16~~18 and lower cladding 16 on the formed waveguide 6 and Ge mesa 4. --

Please replace the paragraph on page 5, line 19 with the following amended paragraph:

-- To obtain such Brewster angles the coupling between the waveguide 6 and the Ge mesa 4 are formed under various growth facets. In this case, grow facets of {111} and {001} can obtain an angle of approximately of 35°. Also, growth facets of {211} and {001} can obtain an angle of approximately 24° and growth facet of {001} can obtain an angle of 17.5°. These angles fall in the Brewster angle $\pm$ 10°. Note that these near Brewster angles can be obtained by using other standard processing techniques known in the art. --

Please replace the paragraph on page 6, line 3 with the following amended paragraph:

-- FIGs. 2A-2B are graphs demonstrating the reflections of TE and TM modes of the coupling device 2 described in FIG. 1. FIG. 2A shows the reflections of the TE modes in the coupling device 2. Note that the coupling device 2 exhibits high TE reflection. This is a problem because the TE reflections are significant even at the Brewster angle. The invention will address this issue more ~~issue~~ hereinafter. FIG. 2B shows the TM reflections in the coupling device 2. In this case, the reflections of TM modes are significantly lower which makes the structure a better coupling device because of this increase in coupling efficiency. --

Please replace the paragraph on page 6, line 16 with the following amended paragraph:

-- FIG. 3 is a schematic diagram of a waveguide-semiconductor coupling device ~~20~~ 21 using a SiNx waveguide 22 that includes a multimode interferometer (MMI). In addition, the coupling device ~~22~~ 21 includes a Ge mesa 24 and a Ge detector 26 that are formed on a Si layer 28, and is surrounded by SiO_2. The SiNx waveguide 22 also includes a polarization rotator 28 to

rotate the polarization from TE to TM. --

Please replace the paragraph on page 7, line 6 with the following amended paragraph:

-- FIGs. 4A-4D are schematic diagrams illustrating fabrication steps to form the coupling device ~~20~~ 21 shown in FIG. 3. FIG. 4A shows a SOI structure that includes a SiO_2 layer 30 and the Si layer 28. Note that the Si layer ~~20~~ 28 should include crystalline Si for efficient growth of the crystalline Ge mesa layer 24. The SOI structure is etched with Si on all areas except those where Ge epilayers will be deposited to form the Ge mesa 24. Afterwards, a layer 32 of SiO_2 is deposited on the side exposed by Si etching. FIG. 4B shows that Ge epilayers are deposited on the Si layer 28 to form the mesa 24. The edge of mesa 24 is facetted with {111}, {311}, or the like planes to form the necessary the Brewster angle described herein. Note the detector 26 is also formed on the Si layer ~~26~~28. FIG. 4C shows the SiNx materials, which include the MMI structures, being deposited to form waveguide 22. In particular, the waveguide 22 is a SiNx mesa structure having tapered edge in the opposite direction of the Ge mesa 24. FIG. 4D shows a second layer (or upper layer) 36 of SiO_2 being deposited on so the coupling device ~~20~~ 21 is enclosed by SiO_2. Furthermore, the polarization rotator 40 can be included at any point after the formation of the waveguide 22. --

Please replace the paragraph on page 7, line 21 with the following amended paragraph:

-- FIGs. 5A-5B are graphs demonstrating the reflections of TE and TM modes of the coupling device~~20~~ 21 described in FIG. 3. FIG. 5A shows the reflections of the TE modes in the coupling device 20. Note that the coupling device ~~20~~ 21 exhibits lower TE reflection, as compared to the coupling device ~~20~~ 2 of FIG. 2. Therefore, the incorporation of MMI materials in the SiNx waveguide 22 increases the coupling efficiency of TE mode. FIG. 5B shows the TM reflections in the coupling device ~~20~~21. In this case, the reflections of TM modes are similar to those shown in FIG. 2B. This illustrates that the incorporation of MMI in the SiNx waveguide 22 does not affect the coupling of TM modes. --